PATENT SPECIFICATION
DRAWINGS ATTACHED

1,022,824

1,022,824

Date of Application and filing Complete Specification April 26, 1963.
No. 16518/63.
Application made in Germany (No. T22041 XI/81e) on April 28, 1962.
Complete Specification Published March 16, 1966.

Index at acceptance:—B6 B(10A1E, 10A1F, 10A4, 10C1B, 10C5, 10CX, 10E1, 10E4, 10L4, 10LX)
Int. Cl.:—B 65 h

COMPLETE SPECIFICATION

A Device for Receiving Irregularly Supplied Flat Articles and Discharging Them one at a time

We, TELEFUNKEN PATENTVERWERTUNGS-GESELLSCHAFT M.B.H., of 3, Elisabethenstrasse, Ulm/Donau, West Germany, a German Body Corporate, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to the automatic handling of flat articles, such as letters, postcards or documents, and the invention is particularly concerned with a device for delivering singly flat articles which are supplied to the device at random, that is to say several at a time one covering the other or in an overlapped condition, and on edge by a supply conveyor.

The invention consists in a device for the delivery in succession flat articles, such as letters or documents, which are supplied to the device one covering the other or in an overlapped condition, comprising

(a) a supply conveyor for the supply of the articles on edges between two guide walls,

(b) a separating device which forms the end portion of the one guide of the supply conveyor and is formed

(i) by a wall having a suction recess which faces the channel through which the flat articles arrive, which is connected to a source of low pressure, and which is arranged at a distance *a* from the end of a delivery conveyor arranged beyond the supply conveyor, which distance is smaller than the smallest length of the flat articles to be handled,

(ii) by an endless belt provided with suction openings, one run of this suction belt passing in the conveying direction over the surface of the suction wall that faces the flat articles, and

(iii) by one or more strippers which are arranged in the region of the said distance *a* and designed to allow only that flat article to pass which is in contact with the said suction conveyor belt,

(c) a delivery conveyor extending from the end of the said separating device to grip and convey a flat article advanced by the separating device.

It is an advantage to make the arrangement such that the number *n* of strippers arranged in succession in the conveying direction corresponds to the number of flat articles to be held when a plurality of articles is advanced into the said region *a*, and that the length *b* of the suction recess measured in the conveying direction substantially satisfies the condition

$$b < 15 \cdot d \cdot (n+1)$$

wherein *d* repreesnts the thickness of the thinnest flat article to be handled.

In order that the invention may be clearly understood, it will now be described by way of example in more detail with reference to the accompanying drawings, wherein

Figure 1 is a diagrammatic plan view partially in section of a first embodiment of the present invention,

Figure 2 is a diagrammatic side view of the arrangement illustrated in Figure 1,

Figure 3 is a vertical sectional view taken along the plane defined by reference line III—III of Figure 2,

Figure 4 is an enlarged and partial sectional view illustrating the suction point and a first stripping device in one phase of operation of the device, shown in Figures 1 to 3,

Figure 5 is an enlarged and partial sectional view similar to Figure 4, illustrating another phase of operation,

Figure 6 is a diagrammatic plan view of a second embodiment of the invention,

Figure 7 is a sectional view taken along

[*Price* 4*s*. 6*d*.]

the plane defined by reference line VII—VII of Figure 6 but on an enlarged scale,

Figure 8 is an enlarged side view of the supply conveying path illustrated in Figure 6, and

Figure 9 is a fragmentary view illustrating a section of the suction conveying belt.

In the device illustrated in Figures 1 to 5, flat articles 1, for instance letters, are supplied on edge by means of a horizontal conveyor belt 3 which is driven in the direction of the arrow 2 and the guide roller of which, visible in the drawing, is designated by 4. A conveying channel is formed above the conveyor belt 3 by means of side walls 5 and 7. The side wall 5 is bent at its end, seen in the conveying direction, to form an end wall 6. The side wall 7 ends ahead of the end wall 6 and is replaced by a wall 8 which has a recess 10 to form a suction chamber 9 provided with a suction port which is connected (not illustrated) through a pipeline to a vacuum source. Moving in front of this suction chamber 9 and the wall 8 is a run of an endless conveyor belt 11 which is formed by three parallel individual belts and drive and guide rollers 12 and 13 respectively. The surface of the conveyor belt has a relatively high coefficient of friction at least on the side where it faces the articles 1.

The interspaces between the three individual belts form suction apertures 11^1 which extend uniformly over the whole length of the suction conveyor belt 11. At a distance *a*, which is shorter than the length of the shortest flat article to be processed, there are arranged feed rollers 14 and 15 of a pair of conveyor belts 16 and 17, which rollers rotate at a uniform speed. Mounted one behind the other in the conveying direction, in the region *a*, that is to say between the suction recess 10 and the rollers 14, 15, are two so-called vacuum strippers 18 and 19 which are mounted for pivoting about pins 20, 21 and are gently and resiliently biased against the suction conveyor belt 11. They are of shoe-like construction and each has a small cavity which, as can be seen for the stripper 18 in Figures 4 and 5, is in communication with a vacuum source through a pipe 22. The wall adjacent to the conveyor belt 11 is provided with an aperture 18^1 and is extended and bent obliquely to form an oblique entry surface 18^{11} at the inlet side. The suction force appearing at the aperture 18^1 is so chosen that the frictional force between the stripper and a flat article in contact therewith is greater than the frictional force between this flat article and another flat article present beneath it, but less than the entrainment force between the suction conveyor belt 11 and a flat article lying directly on this belt in the region of the suction recess 10. Strippers of this kind are described in the U.K. Specification No. 949,594. Their particular mode of operation in the present connection will be explained hereinafter. In order to improve their operation still further, they could be supplemented by so-called air-blast strippers, described in U.K. Specification No. 944,339.

It is an advantage to make the length *b* of the suction recess 10 smaller than $15.d.(n.+1)$ wherein *d* is the thickness of the thinnest article and *n* is the number of strippers arranged in the conveying direction. If the thickness *d* of the thinnest flat article to be processed is assumed to be about d= 0.2 mm, corresponding to the thickness of postcards, and if, as shown, two strippers 18 and 19 are provided to hold back at least two multiple withdrawals at a time, then a value is obtained for the length *b* which is less than $15.\ 0.2.(2+d)=9$ mm. For the sake of clarity, this length *b* is not shown to scale in Figures 1, 4 and 5; its relationship to the thickness *d* of the items shown, however, corresponds approximately to the stated requirement.

Flat articles 1 supplied by the supply conveyor belt 3 in the channel bounded by the walls 5, 6 and 7 arrive with the cooperation of the conveyor belt 11, in the region of the suction recess 10. There they are drawn against the conveyor belt 11 and are advanced, overcoming the retaining force of the strippers 18 and 19, until their leading edge reaches the rollers 14 and 15. They are then gripped by these rollers and delivered for further processing by the conveyor belts 16, 17.

As already mentioned, one difficulty in separation without previous stacking of flat articles consists in that some of the articles, which are supplied at random, may arrive simultaneously, others in an overlapped condition so that two or more articles are drawn simultaneously at the suction recess 10 against the belt 11 so that multiple withdrawals occur. In Figure 4, the length *b* of the suction recess 10 is dimensioned in such a manner that two or three flat articles in overlapped condition can be drawn simultaneously against the conveyor belt 11. To such articles 1^1 and 1^{11} are illustrated, of which the article 1^1 bears directly against the belt 11, while the article 1^{11} bearing against the article 1^1 projects so far with its leading edge that its front portion is likewise attracted. In the first instance, therefore, both articles 1^1 and 1^{11} will participate in the conveying movement of the belt 11. As soon as the article 1^{11} reaches the range of operation of the vacuum stripper 18, however, it is held by this so that only the article 1^1 is caused to move forwards towards the rollers 14 and 15. Since the article 1^1 moves past the suction point 10, the point of action at which the necessary entrainment friction prevails between the article and the conveyor belt is displaced towards the rear edge of the article. As soon as the article 1^1 has been gripped by the rollers 14, 15 and

its rear edge leaves the suction point 10, the article 1^{11}, which was hitherto covered by the article 1^{1} is drawn towards the belt 11 and likewise advanced towards the conveyor rollers 14 and 15 against the retaining force of the strippers 18, 19. If in addition to a second article 1^{11} yet a third article is attracted at the suction point 10, this third article is held back by the first stripper 18 during the further advance, while the article 1^{11} is then held by the second stripper 19. The dimension given for the length *b* of the suction recess 10 ensures that number of articles that can be attracted at the suction recess can only exceed by one the number of articles that can be held back by the strippers present.

In its basic mode of operation, the embodiment of the invention shown in Figure 6 coincides with that described with reference to Figures 1 to 5. The corresponding components 3 to 10 and 12 to 19 are therefore provided with the same reference numerals in the drawing. It differs from that described first in that the conveying section which forms the separating device joins the supply conveyor section containing the horizontal conveyor belt 3 at an obtuse angle.

In order to obtain as favourable deflection of the articles as possible at the apex of this obtuse angle, a rotating deflection brush 23 is provided which is driven in accordance with the conveying direction and projects into the conveying channel through a slot 7^{1} in the wall 7; see Figure 8. It can be seen that the bristles 23^{1} of the brush are guided between two discs 23^{11}. It is an advantage to make the drive for this deflecting brush independent of the drive for the supply conveyor belt 3 so that the brush can continue to run when the conveyor belt 3 is switched off under certain conditions as described hereinafter.

In order to improve the operation of the device still further, a deflecting member 25, deflecting the articles towards the endless suction belt 24, is provided in the admission zone of the actual separating section. A flexibly mounted guide wall could serve as such a deflecting member. Alternatively, a blast nozzle 25^{1}, connected to a source of compressed air, could be used for this purpose.

In the example shown in Figure 6, the endless suction belt 24 has apertures 24^{1} distributed equally over its whole extent, as shown in Figure 9.

In order to ensure, with even greater certainty, that the flat articles 1 bear against the suction point 10 in the separating section even if they are originally delivered laterally spaced apart therefrom, the device shown in Figure 6 is provided with auxiliary pneumatic means shown on an enlarged scale in Figure 7. Suction apertures 26, which are in communication with a suction chamber 27, are provided in the wall 8 in the region of and above the suction point 10.

In order to supplement the action of these suction means, blast apertures 28 are provided in the opposite wall 5 and these apertures are in communication with an air chamber 29, which is connected to a blower not illustrated. The arrangement of the apertures 26 and 28 at a greater height than the suction point 10 and the conveyor belt 24 respectively has the advantage that the separation of flat articles of large size in particular is facilitated. A further improvement in deflecting the flat articles towards the suction point 10 can be achieved by the provision of further apertures 28^{1} in the wall 5 below the said blast apertures 28, which apertures 28^{1} are likewise in communication with the high-pressure chamber 29, but are operated at a lower pressure or with a smaller throughput of air than the apertures 28.

In the separator shown in Figure 6, the rollers 14 and 15 form an independent conveying device while the conveyor belts 16 and 17 of the outgoing conveying section run over their own guide rollers 14^{1} and 15^{1}.

If individual delivery of the flat articles is desired with a predetermined spacing between each two successive articles, then the conveyor rollers 14 and 15 are caused to run at a peripheral speed which is considerably greater than the speed of the suction conveyor belt 11 in Figure 1 or 24 in Figure 6. It is then also advisable to reduce the length of the suction recess 10 still further, for example so that it is less than $10.d.(n+1)$. Furthermore, in practice it has proved favourable to operate the suction conveyor belt 11 or 24 at a higher conveying speed than the supply conveyor belt 3.

An automatic control of the supply conveying section depending on the number of flat articles in the separating section may also be provided. For this purpose, a feeler member, for instance in the form of a feeler arm 30 shown in Figure 6, may be provided in the separating section. As shown in Figure 6, this feeler arm is constructed in the form of a two-armed lever which is mounted for pivoting about a pin 31 and actuates a switch 32 with its outer arm according to the fullness of the separating section. This switch is inserted in the circuit of the drive for the conveyor belt 3 in such a manner that the conveyor belt is stopped or its speed is reduced when the fullness of the separating section exceeds a certain extent and starts up again when this excess has been reduced.

WHA WE CLAIM IS:—

1. A device for the delivery in succession flat articles, such as letters or documents, which are supplied to the device one covering the other or in an overlapped condition, comprising

(a) a supply conveyor for the supply of the articles on edges between two guide walls,

(b) a separating device which forms the end portion of the one guide wall of the supply conveyor and is formed

(i) by a wall having a suction recess which faces the channel through which the flat articles arrive, which is connected to a source of low pressure, and which is arranged at a distance *a* from the end of a delivery conveyor arranged beyond the supply conveyor, which distance is smaller than the smallest length of the flat articles to be handled,

(ii) by an endless belt provided with suction openings, one run of this suction belt passing in the conveying direction over the surface of the suction wall that faces the flat articles, and

(iii) by one or more strippers which are arranged in the region of the said distance *a* and designed to allow only that flat article to pass which is in contact with said suction conveyor belt,

(c) a delivery conveyor extending from the end of the said separating device to grip and convey a flat article advanced by the separating device.

2. A device as claimed in Claim 1, wherein the number *n* of strippers arranged in succession in the conveying direction corresponds to the number of flat articles to be held by the strippers when a plurality of articles is advanced into the said region *a*, and wherein the length *b* of the said suction recess measured in the conveying direction substantially satisfies the condition

$$b < 15 \cdot d \cdot (n+1)$$

wherein *d* represents the thickness of the thinnest flat article to be handled.

3. A device as claimed in Claim 1 or 2, wherein the advancing speed of the said endless suction belt is higher than the advancing speed of the said supply conveyor.

4. A device as claimed in any one of the preceding claims, wherein the advancing speed of the said delivery conveyor is larger than the advancing speed of the said endless suction belt.

5. A device as claimed in Claim 2, wherein the said length *b* satisfies the condition $b < 10.d.(n+1)$.

6. A device as claimed in any one of the preceding claims, wherein the delivery conveyor is formed by a pair of parallel conveyor rollers which co-act with one another and are caused in operation to rotate in opposite directions.

7. A device as claimed in Claim 6, wherein each of the two rollers forms the one of two guide rollers of an endless conveyor belt, the gripped flat articles being conveyed between the adjacent runs of the two conveyor belts.

8. A device as claimed in any one of the preceding claims, wherein the said endless suction belt that passes over the said suction wall, is a perforated belt.

9. A device as claimed in any one of the preceding claims 1 to 7, wherein the said endless suction belt that passes over the said suction wall is formed by a number of parallel narrow belts, the suction openings being formed by the interspaces between the individual belts.

10. A device as claimed in any one of the preceding claims, wherein the or each stripper is formed by a suction stripper, its suction head being gently and resiliently biased into contact with the said endless suction belt or with an article present on this belt.

11. A device as claimed in Claim 10, wherein the the or each of said suction strippers is supplemented in its action by an air-blast stripper which likewise is gently and resiliently biased into contact with the said endless suction belt or with an article present on this belt.

12. A device as claimed in any one of the preceding claims, wherein a deflecting device is arranged in the region of the suction belt upstream of the suction opening in such a manner that it deflects the flat articles towards the suction belt.

13. A device as claimed in Claim 12, wherein the said deflecting device is formed by a resilient guide plate.

14. A device as claimed in Claim 12, wherein the said deflecting deivce is formed by a nozzle connected to a source of compressed air so as to form a jet directed against the suction belt.

15. A device as claimed in any one of the preceding claims 1 to 11, comprising additional suction and/or jet forming devices in the region of the said suction opening so as to deflect the flat articles towards the suction opening.

16. A device as claimed in Claim 15, wherein the said additional suction and/or jet forming devices are disposed in a region above the said suction opening.

17. A device as claimed in any one of the preceding claims, wherein the said separating device and the said supply conveyor form an obtuse angle.

18. A device as claimed in Claim 17, wherein a revolving deflecting brush is arranged at the junction between the separating device and the supply conveyor so as to deflect the flat articles supplied by the supply conveyor into the separating device.

19. A device as claimed in any one of the preceding claims, comprising a feeler member to monitor the number of articles present in the separating device, which feeler member controls the advancing speed of the supply conveyor to reduce the speed or to stop its advance when the said number exceeds a predetermined limit.

20. A device as claimed in Claim 18, where-

in the rotary speed of the revolving deflecting brush is independent of the advancing speed of the supply conveyor.

21. A device for delivering in succession flat articles substantially as described with reference to and as illustrated in Figures 1 to 5 or in Figure 6 to 9 of the accompanying drawings.

For the Applicants:
MATTHEWS, HADDAN & CO.,
Chartered Patent Agents,
31—32, Bedford Street,
Strand, London, W.C.2.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1966.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

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Sheet 1

Fig. 2

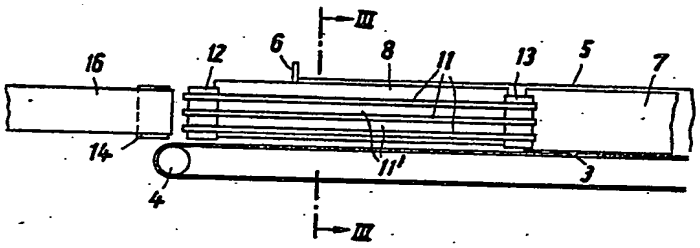


Fig. 1

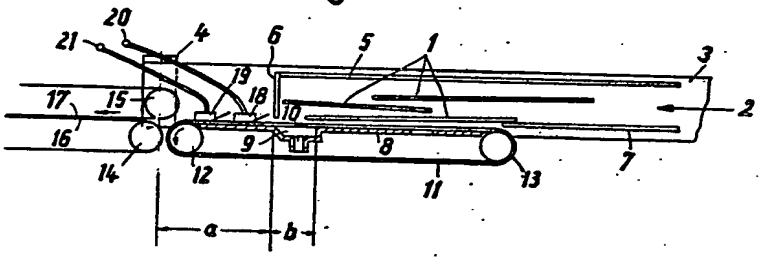
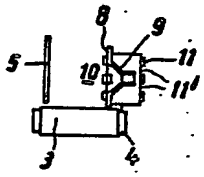


Fig. 3



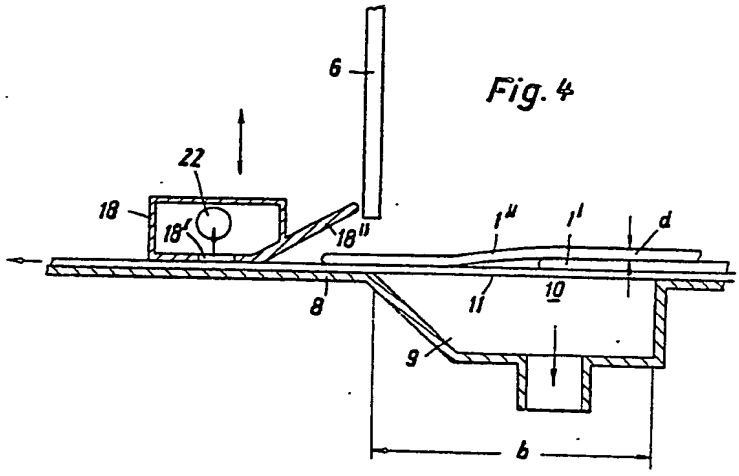


Fig. 4

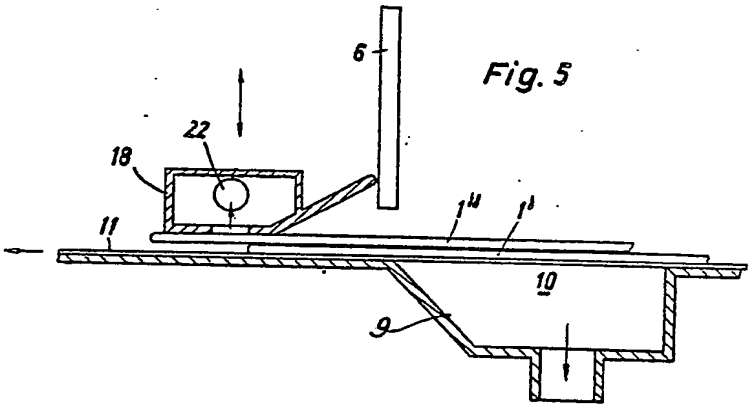


Fig. 5

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Fig. 7

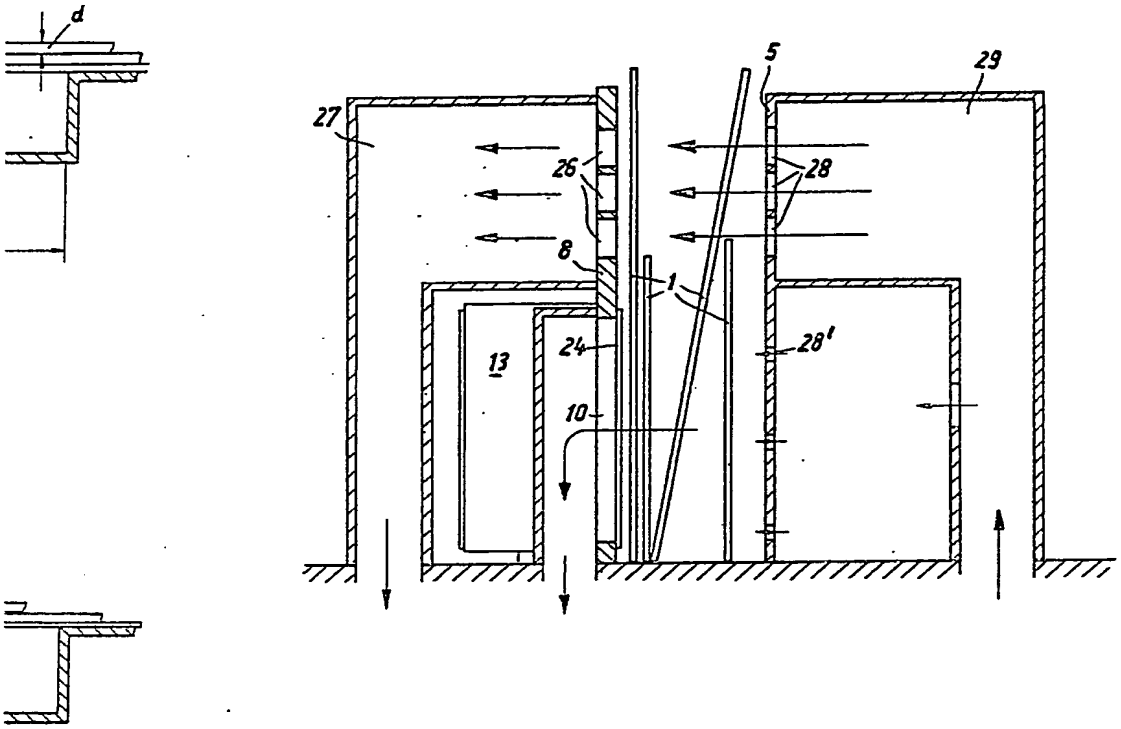

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Fig. 4

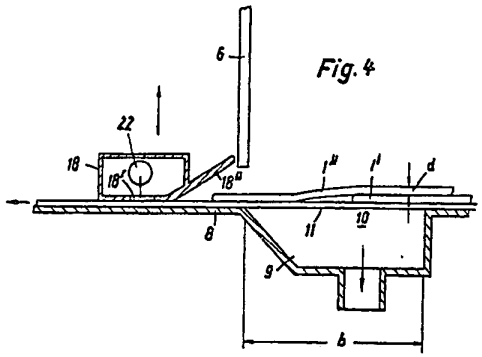


Fig. 5

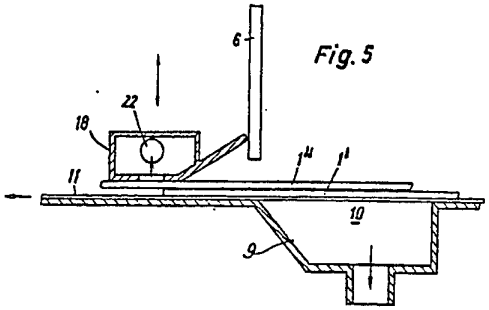
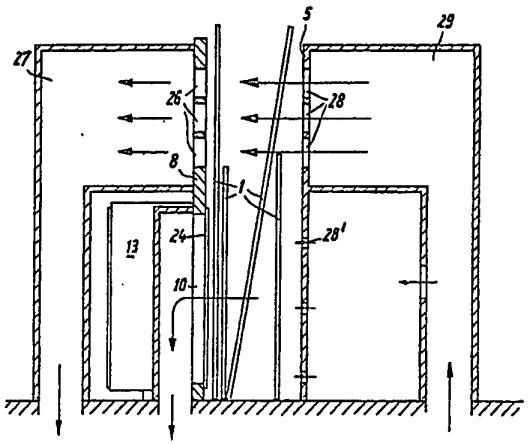


Fig. 7



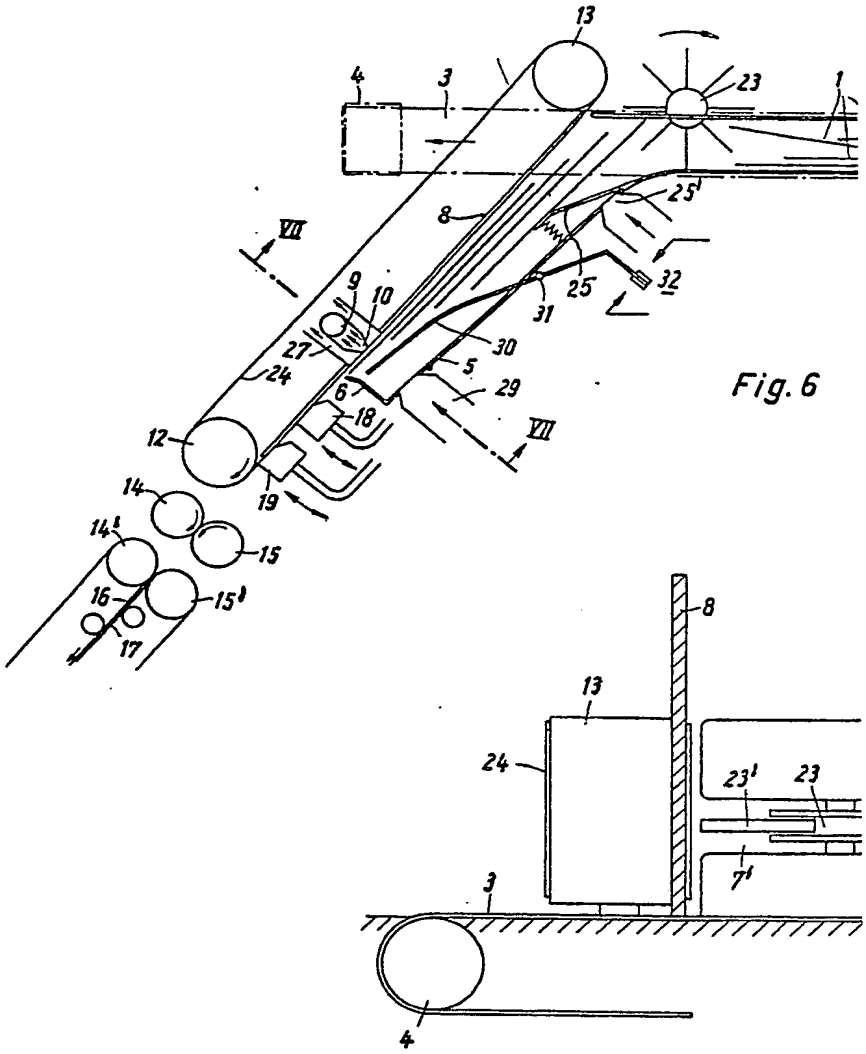


Fig. 6

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Sheet 4

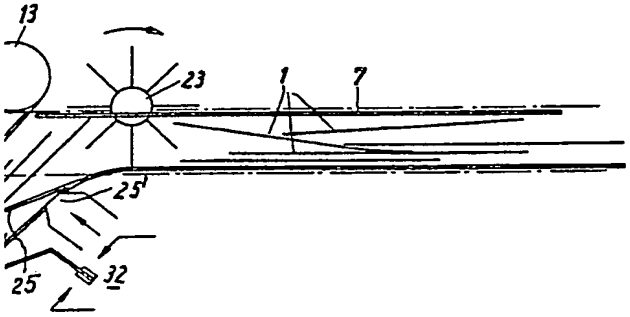

Fig. 6

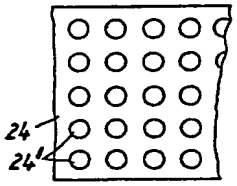

Fig. 9

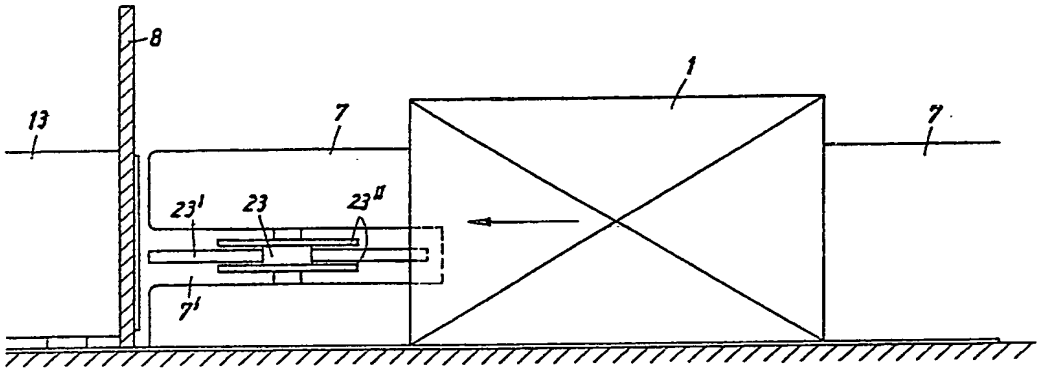

Fig. 8

1022824 COMPLETE SPECIFICATION
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Sheet 4

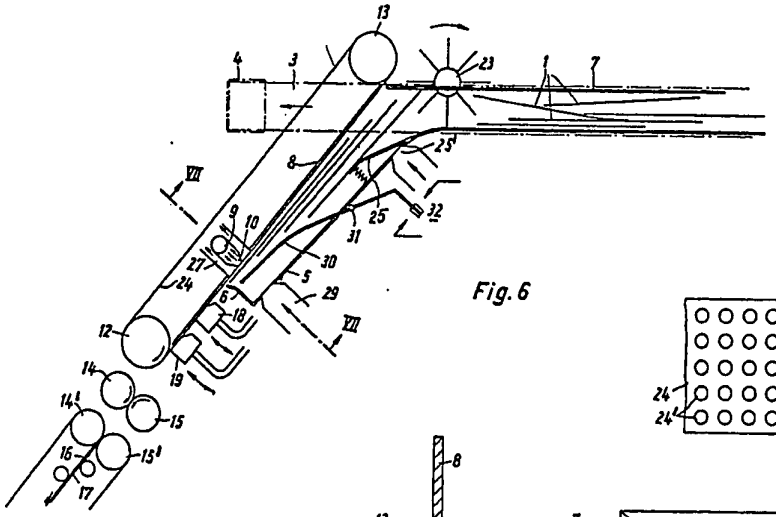

Fig. 6

Fig. 9

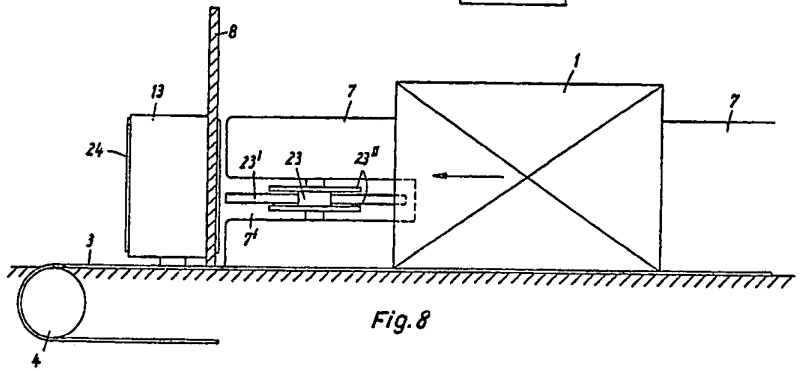

Fig. 8